Amendments to the Specification:

Please amend the specification, beginning on page 16, line 4, as follows:

System operation shall be described with respect to M antenna transducers 26 and L receive antenna transducers 32. The subscripts of T, H, and * shall herein refer to transposition, Hermitian, and complex conjugation operators. The sample rate at which the data is sampled shall be assumed to be the same as the transmitted symbol rate and the channel impulse response of the communication channel upon which the symbols are transmitted is represented by:

$$\underline{\mathbf{h}_{ml} = [h_{ml,1} \quad h_{ml,2} \quad \cdots \quad h_{ml,W}]^T}$$

$$\cancel{\mathbf{h}_{ml} = [h_{ml,1}, h_{ml,2}, \ldots h_{ml,W}]^T}$$

Equation 1

wherein:

m refers to the m-th transmit antenna transducer;

l refers to the l-th receive antenna transducer; and

W represents the maximum number of communication paths, here assumed to be the same for all radio links.

An over sampling situation is easily accommodated by the structure of the communication system, and the communication channel is assumed to be time-invariant for a data burst duration, and perfectly known at the receiver.

A burst of N symbols sent by the m-th transmit-antenna transducer is represented as:

$$\underline{\mathbf{x}_m = \begin{bmatrix} x_{m,1} & x_{m,2} & \cdots & x_{m,N} \end{bmatrix}^{\mathrm{T}}}$$

$$\cancel{\mathbf{x}_m = [x_{m,1}, x_{m,2} \ldots x_{m,N}]^T}$$

Equation 2

The signal received at the mobile station by the l-th antenna transducer 32 is represented as:

$$\mathbf{r}_l = \sum_{m=1}^{M} \mathbf{H}_{ml}\,\mathbf{x}_m + \mathbf{n}_l$$

Equation 3

wherein:

$\underline{\mathbf{n}_l}$ ~~$\mathbf{n}_l$~~ is the complex additive white Gaussian noise (AWGN) at the l-th receive antenna transducer and $\underline{\mathbf{H}_{ml}}$ ~~$\mathbf{H}_{ml}$~~ is the channel matrix corresponding to the m-th transmit antenna transducer and the l-th receive antenna transducer and which has the form:

$$\mathbf{H}_{ml} = \begin{bmatrix} h_{ml,1} & 0 & \cdots & 0 \\ h_{ml,2} & h_{ml,1} & \ddots & \vdots \\ \vdots & h_{ml,2} & \ddots & 0 \\ h_{ml,W} & \vdots & \ddots & h_{ml,1} \\ 0 & h_{ml,W} & \ddots & h_{ml,2} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & h_{ml,W} \end{bmatrix}_{N+W-1\times N}$$

Equation 4

The data symbols that are applied to the space-time encoder ~~is~~ are denoted by the $\underline{\mathbf{x} = [x_1 \quad x_2 \quad \cdots \quad x_K]^{\mathrm{T}}}$ ~~$\mathbf{x}=[\mathbf{x}_1, \mathbf{x}_2, \ldots \mathbf{x}_K]^{\mathrm{T}}$~~. With this denotation, the following relation with respect to the space-time encoded symbols is formed:

$$\underline{\mathbf{x}_m = \mathbf{x}_m^{\mathrm{R}} + j\mathbf{x}_m^{\mathrm{I}} = \mathbf{P}_m \mathbf{x}^{\mathrm{R}} + j\mathbf{Q}_m \mathbf{x}^{\mathrm{I}}}$$

$$\cancel{\mathbf{x}_m = \mathbf{x}_m{}^{\mathrm{R}} + j\mathbf{x}_m{}^{\mathrm{I}} = \mathbf{P}_m \mathbf{x}^{\mathrm{R}} + j\mathbf{Q}_m \mathbf{x}^{\mathrm{I}}}$$

Equation 5

wherein: $\underline{\mathbf{P}_m}$ ~~$\mathbf{P}_m$~~, $\underline{\mathbf{Q}_m}$ ~~$\mathbf{Q}_m$~~, are N×K matrices; and

the superscripts R and I denote the real and imaginary parts of the scalar values and matrices of the equation.

The values of $\mathbf{x}_m$ ~~$\mathbf{x}_m$ is~~ are generated via a morphism from $\mathbf{x}$ ~~$\mathbf{x}$~~, involving the $\mathbf{P}_m$ ~~$\mathbf{P}_m$~~ and $\mathbf{Q}_m$ ~~$\mathbf{Q}_m$~~ operators. The matrices $\mathbf{P}_m$ ~~$\mathbf{P}$~~ and $\mathbf{Q}_m$ ~~$\mathbf{Q}$~~ have left inverses $\tilde{\mathbf{P}}_m$ and $\tilde{\mathbf{Q}}_m$, respectively, of size K×N which, when multiplied together with their counterparts, form an identity matrix of the size K, i.e., $\tilde{\mathbf{P}}_m \mathbf{P}_m = \tilde{\mathbf{Q}}_m \mathbf{Q}_m = \mathbf{I}_K$ ~~$\mathbf{I}_k$~~. With consideration of a conventional space-time block node (STBC), the following equations are represented:

$$\underline{\mathbf{x}_1 = [x_1 \quad x_2]^{\mathrm{T}} = \mathbf{I}_2 \mathbf{x}^{\mathrm{R}} + j\mathbf{I}_2 \mathbf{x}^{\mathrm{I}}}$$

$$\cancel{\mathbf{x}_1 = [x_1\ x_2]^{\mathrm{T}} = \mathbf{I}_2 \mathbf{x}^{\mathrm{R}} + j\mathbf{I}_2 \mathbf{x}^{\mathrm{I}}}$$

Equation 6

$$\underline{\mathbf{x}_2 = \left[-x_2^* \quad x_1^*\right]^{\mathrm{T}}}$$

$$\cancel{\mathbf{x}_2 = [-x_2^*\ x_1^*]^{\mathrm{T}}}$$

Equation 7

Equation 6 is exemplary of a data burst of a length of two. An analogous relation can be represented for a longer data burst, e.g., to N, by using a tensor product between the identity matrix and the corresponding **P** and **Q** matrices.

Operation of the decoder of an embodiment of the present invention by which to directly combine the values of the data transmitted upon the separate communication ~~paths~~ channels to the mobile station exploits correlations which exits amongst $\underline{\mathbf{x}_m}$ ~~$\mathbf{x}_m$~~ and $\underline{\mathbf{x}}$ vectors. By substituting the values of Equation 5 into Equation 3 above, the following results:

$$\underline{\mathbf{r} = \mathbf{H}_r \mathbf{x}^R + \mathbf{H}_i \mathbf{x}^I + \mathbf{n}}$$

$$\cancel{\mathbf{R} = \mathbf{H}_r \mathbf{x}^R + \mathbf{H}_i \mathbf{x}^I + \mathbf{n}}$$

Equation 8

where:

$$\mathbf{H}_r = \sum_{m=1}^{M} \mathbf{H}_m \mathbf{P}_m \text{ and } \mathbf{H}_i = j\sum_{m=1}^{M} \mathbf{H}_m \mathbf{Q}_m$$

Equation 9

Match filtering is then performed, successively using $\underline{\mathbf{H}_r^H}$ $\cancel{\mathbf{H}_r^H}$ and $\underline{\mathbf{H}_i^H}$ $\cancel{\mathbf{H}_i^H}$, thereby to yield:

$$\underline{\mathbf{H}_r^H \mathbf{r} = \mathbf{y}_r = \mathbf{R}_{11}\mathbf{x}^R + \mathbf{R}_{12}\mathbf{x}^I + \mathbf{z}_r}$$

$$\cancel{\mathbf{H}_r^H \mathbf{H}_r = \mathbf{y}_r = \mathbf{R}_{11}\mathbf{x}^R + \mathbf{R}_{12}\mathbf{x}^I + \mathbf{z}_r}$$

Equation 10

$$\underline{\mathbf{H}_i^H \mathbf{r} = \mathbf{y}_i = \mathbf{R}_{21}\mathbf{x}^R + \mathbf{R}_{22}\mathbf{x}^I + \mathbf{z}_i}$$

$$\cancel{\mathbf{H}_i^H \mathbf{H}_r = \mathbf{y}_i = \mathbf{R}_{21}\mathbf{x}^R + \mathbf{R}_{22}\mathbf{x}^I + \mathbf{z}_i}$$

Equation 11

By denoting $\underline{\mathbf{y}_{CD} = \left[\mathbf{y}_r^T \quad \mathbf{y}_i^T\right]^T}$ $\cancel{\mathbf{y}_{CD} = [\mathbf{y}_r^T \ \mathbf{y}_i^T]^T}$, $\underline{\mathbf{x}_{CD} = \left[(\mathbf{x}^R)^T \quad (\mathbf{x}^I)^T\right]^T}$ $\cancel{\mathbf{x}_{CD} = [(\mathbf{x}^R)^T (\mathbf{x}^I)^T]^T}$ and $\underline{\mathbf{R}_{CD} = \{\mathbf{R}_{kn}, \forall k, n = 1,2\}}$ $\cancel{\mathbf{R}_{CD} = \{\mathbf{R}_{kn}, \forall k,n=1,2\}}$ to form:

$$\mathbf{y}_{CD}^R = \mathbf{R}_{CD}^R \mathbf{x}_{CD} + \mathbf{z}_{CD}^R$$

Equation 12

One way to solve Equation 12 is using the inverse of $\underline{\mathbf{R}^{R}_{CD}}$ $\cancel{\mathbf{R}_{CD}{}^{R}}$, i.e.

$$\hat{\mathbf{x}}_{CD} = \mathrm{dec}\left[\left(\mathbf{R}^{R}_{CD}\right)^{-1}\mathbf{y}^{R}_{CD}\right]$$

Equation 13

Where dec[·] represents the decision device.

Analysis of the above equation indications that estimates of real and imaginary parts of $\mathbf{x}$ are given directly, i.e., $\underline{\mathbf{x}_{CD}}$ $\cancel{\mathbf{x}_{CD}}$ is a real vector. Operation of the decoder to first directly-combine and then to detect values of the data after all of the information regarding a particular symbol has been properly combined. Improved efficiency of computations required to perform the operations of the decoder is provided by the decoder of an embodiment of the present invention. The dimension of $\underline{\mathbf{R}^{R}_{CD}}$ $\cancel{\mathbf{R}_{CD}{}^{R}}$ is 2K×2K which is smaller than the MN×MN used in conventional decoder operation. And, the decoder of an embodiment of the present invention requires only operations to be performed upon real, rather than complex matrices.